Diversity and distribution of aromatic plants in forests of Gorakhpur division, U.P., India

Abhay K. Pandey and N.N. Tripathi
Bacteriology & Natural Pesticide Laboratory, Department of Botany, DDU Gorakhpur University, Gorakhpur (U.P.)

ABSTRACT: A field survey of wild aromatic plants distributed in forests of Gorakhpur division indicates 44 species of aromatic plants that belong to 32 genera and 14 families. Of which many are being used in day to day medical therapy. In addition to this the richest period for flowering and fruiting in aromatic plants was Dec.-April. Out of 14 families studied Asteraceae occupied top most position; however Araceae, Cannabinaceae, Capparidaceae, Chenopodiaceae and Polygonaceae represented only one species of each. This study indicates that the area harbors a high diversity of aromatic plants and their application as medicines may be exploited.

Keywords: Aromatic plants, forests, medicinal value.

INTRODUCTION

The use of aromatic plants has been out of focus throughout the history. At present, this is a popular treatment strategy for a variety of ailments. According to WHO estimate, about 80% of the population in developing countries depends directly on plants for its medication (Kosalge and Fursule, 2009). India has a rich assortment of diversity of medicinal and aromatic plants distributed in different geographical and ecological conditions in the country. Out of total 17,500 species of flowering plants in India only 1300 species are of aromatic nature (Uniyal et al., 2002). In present study an attempt has been made to collect the aromatic plants from different forests of Gorakhpur division with their collection number. Besides, observation on habit, habitat, local name, flowering/fruiting and medicinal uses in human welfare have also been made.

Study area and Vegetations

The forests taken in present investigation are situated in Eastern part of Uttar Pradesh between latitude of 27º05’ to 27º25’ North and longitude of 83º20’ to 84º10’ East. The division comprises Maharajganj, Gorakhpur, Kushinagar and Deoria districts. Out of which forests are only situated in Maharajganj and Gorakhpur districts. The soil of this area is gangatic alluvial brought down by rivers like Ghaghara, Rapti, Rohin and Gandak from the Himalayas. The rainfall varies considerably from year to year. The monsoon rains commence during June and continue to an end in September but may persist till October. The minimum temperature goes down to 6ºC in the month of January & maximum up to 43ºC in the month of June.

The Gorakhpur Division is a tarai region has dense forest covers close to the foothills of Himalayas. All the forests of Gorakhpur Division including Achalgarh, Banki, Campierganj, Chowk, Kushmahawa, Kushmahi, Lehradevi, Madanpur (out of Gorakhpur Division), Madhualia, Nichlaul, Pakari, Tehrighat and Tilkonia are rich in species composition of higher plants. The vegetation of forests consists of herbs, shrubs, trees and climbers. Trees, shrubs and climbers occur throughout the year and form permanent vegetation, while herbaceous plants mostly appearing during rainy season, decreasing during winter and finally become depleted in peak summer.

METHODOLOGY

The present work is based on an intensive survey of aromatic plants of Gorakhpur Division during 2006-2009; in which periodic excursions were made and aromatic plants were collected in flowering and fruiting conditions. The dominance of aromatic plants was recorded on visual basis for presence and absence of species. The plant specimens were assigned collection numbers; their localities and other necessary field information were recorded in field data book. During visit local name, medicinal and traditional uses of plants by native people were noted on the spot and confirmed with the help of literature. The specimens were pressed dried, prepared herbarium and identified using floras (Srivastava, 1976; Singh et al., 2000) as well as by matching their specimens lodged in departmental herbarium of Gorakhpur University and BSI (NRC) Dehradun. The herbarium of collected plants was deposited to BSI, Dehradun.

Enumeration of aromatic plant species

Aromatic plant species collected from forests of Gorakhpur division are enumerated here alphabetically along with common name and mode of application.

Acorus calamus Linn. (Bach)

A semi aquatic, rhizomatous perennial herb, rhizome creeping, much branched, cylindrical, light brown, white and
spongy within. Leaves bright green, distichous, thickened in the middle, margin wavy. Flowers light brown, densely packed in sessile cylindrical spadix. Fruits oblong, turbinate berries.

Dried powder of rhizome is given to children twice daily in fever (Tomar, 2008).

**Adenostemma lavenia** (L.) O. Kuntze (Bhenguar)

An erect annual herb. Leaves simple, opposite, oblong, ovate, sessile or petiolate, crenate or coarsely serrate. Heads homogamous, white, discoid, arranged in dense panicles or corymbs. Calyx modified into pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits cypsela, brown with glandular tubercles.

The extract of plant is used as diuretic, crushed leaves applied to cuts and wounds, and also to treat bites of poisonous insects and caterpillars (Chopra et al., 2006).

**Artemisia nilagirica** (Clarke) Pamp. (Dauna)

An aromatic, perennial shrub, often gregarious, pubescent or villous throughout. Leaves ovate, bipinnate to tripinnate, deeply pinnatisect, pubescent above, white tomentose beneath. Heads homogamous, flowers yellowish white, sessile in sub-erect or horizontal panicked racemes. Calyx modified into pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits achene. Used in chronic fever, swelling and inflammations of liver also employed as tonic and stimulant (Ambasta, 2006).

**Blumea eriantha** DC. (Kukuraunha)


Half cup of leaf infusions taken twice a day for diuretic (Chopra et al., 2006).

**B. laciniata** (Roxb.) DC. (Kukuraunha)

An erect, aromatic, pubescent, annual herb. Leaves simple, alternate, variable, usually large, runcinate-lyrate below and sub-pinnatifid, spinulose above, hairy on both surfaces. Heads heterogamous, yellow in dense to lax panicles. Calyx modified into pappus. Corolla 5, tubular. Stamens 5, syngenesious. Fruits cypsela, flattened.

Plants used against mouth disease of cattle. The essential oils used as antifungal and antibacterial agent (Asolkar et al., 2005).

**B. mollis** DC. (Kukuraunha)

An erect, annual, aromatic leafy herb. Leaves simple, alternate, petiolate, elliptic-lanceolate or obovate, irregularly toothed or serrate, glandular on both surface. Heads heterogamous, purplish in terminal or axillary spiciform dense cymes or panicles. Calyx modified into pappus. Corolla 5, tubular. Stamens 5, syngenesious. Fruits cypsela, linear.

The decoction of whole plant used to treat diarrhea (Asolkar et al., 2005).

**Caesulia axillaris** Roxb. (Bangra)

An erect or sub-erect glabrous marshy annual herb. Leaves alternate, sessile, lanceolate, acuminate, tapering to the auricled base. Heads globose, homogamous, flowers purplish or white, connate together in compound head. Calyx modified into pappus, axillary sessile. Corolla 5. Anther 5, syngenesious. Fruits cypsela, dark brown.

A mixture of this plant and khesari in water is given to cattle in stomach disease; leaf is used in treatment of goiter, plant used in baldness and diarrhea (Asolkar et al., 2005).

**Callicarpa macrophylla** (L.) Vahl (Priyangu)


Roots yield an essential oil used in stomach disorder, leaves warmed and applied to rheumatic joints (Ambasta, 2006).

**Cannabis sativa** Linn. (Bhang)

A scarsely branched, aromatic herb. Leaves upper 1-3 and lower 5-11 partite, lobes lanceolate, serrate. Flowers small, greenish white, dioecious. The male flowers in axillary panicked cymes while female flowers in axillary racemes. Fruits compressed, crustaceous nut.

A poultice of leaves is applied externally around the anus for one month to cure piles (Tomar, 2008).

**Chenopodium ambrosioides** Linn. (Banbhathuwa)

An erect, much branched, aromatic herb or under shrub. Leaves oblong–lanceolate or oblong ovate, obtuse or acute, sinulate-dentate. Flowers green, minute in axillary and terminal simple or panicked leafy spikes. Periendth 5-lobed enclosing the fruits. Stamens 5. Fruits utricle membranous brown.

Used as an anthelmintic against many forms of intestinal parasite (Mishra et al., 2008).

**Clausena pentaphylla** (Roxb.) DC. (Ratanjot)

A small aromatic deciduous shrub. Leaves imparipinnate, tri-hepta foliolate; leaflets alternate or sub-opposite, ovate-elliptic, oblong, lanceolate, margins crenulate, glabrous, gland punctate. Flowers yellowish or greenish white in terminal, downy panicles. Calyx and corolla 4-5 each. Stamens 10. Fruits berry ovoid, orange.
Bark is applied to fresh wounds in powdered form for quick healing (Ali and Dixit, 1989).

**Colebrookea oppositifolia** Sm. (Bantulsi/Pansara)


Leaves used in cuts, wounds and burns. Roots used in hysteria and epilepsy (Ambasta, 2006).

**Curcuma aromatica** Roxb. (Jangalihaldi)


Rhizomes powder used in fever, contusions and sprains (Ambasta, 2006).

**C. zedoaria** Rosc. (Kachur)

A rhizomatous underground herb. An apparent stem is formed by rolled up leaf sheath. Leaves alternate spirally arranged, linear. Inflorescence spikes arise from the sheaths. Flowers yellow.


Used as stimulant tonic, stomachic and relieve from joints pains (Ambasta et al., 2006).

**Cyperus brevifolius** (Rottb.) Hassk. (Mutha)

An erect, slender perennial sedge with horizontal rhizome. Leaves linear, erect, spikes aggregated into terminal solitary globose green heads. Spikelets lanceolate or ovate-lanceolate, 1- flowered. Perienth absent represented by bristles or scales or hairs. Stamens 3. Fruits nuts, yellowish brown.

Readily eaten by cattle. Leaves used in diarrhea (Asolkar et al., 2005).

**C. monocephalus** Endl. (Musta)


Decoction of aromatic rhizomes used as diuretic, demulcent and tonic, also given in fever and diabetes (Ambasta et al., 2006).

**C. squarrosus** Linn. (Motha)

A glabrous, annual sedge with numerous tufted, fibrous roots. Leaves arising near base of stem, usually shorter than stems, linear, tapering in acute apex. Inflorescence umbellate with at least one sessile head like spikes of spikelets. Heads globose or oblong, spikelets oblong, brownish, 10-12 flowered. Stamens 1. Fruits narrowly obovoid.

Decoction of whole plants useful in diarrhoea, plants diuretic, astringent (Chopra et al., 2006).

**C. triceps** (Rothb.) Endl. (Apavisha)

An erect, small, glabrous, annual sedge with small rhizome. Leaves narrow, acuminate, spikes 3-5, ovoid or oblong, white aggregated into a compact head. Rachilla deciduous, perienth absent represented by bristles, scales or hairs. Spikelets, 1-flowered. Fruits nut oblong, ellipsoid and pale brown.

Decoction of plants is given in fever, the root oil used for stimulating liver and to relieve pruritus (Choudhury et al., 2010).

**Erigeron bonariensis** Linn. (Bonaria)


Plants used as stimulating diuretic in febrile condition (Kala, 2005).

**E. canadensis** Linn. (Jrayayupriya)


Decoction of whole plant given for diarrhoea and dysentery (Chopra et al., 2006).

**Eugenia heyneana** (L.) Wall. (Kathamun)

A small to medium sized tree. Leaves narrow, lanceolate, acuminate, glabrous. Flowers greenish white in panicles. Calyx and corolla 4-5 each. Stamens numerous. Fruits berry, crowned by cup like calyx-limb, brown in colour.

Root chewed for relief from tooth ache, used as vermicide, flowers used in inflammation (Mishra et al., 2008).

**Eupatorium cannabinum** Linn. (Tangol-lati)


Diuretic, herb employed as purgative (Ambasta, 2006).
E. odoratum Linn. (Ayapana)


Decoction of leaves haemostatic, aqueous extract of shoots cardiac stimulants (Awasthii, 1991).

Glycosmis pentaphylla Corr. (Karjeer)

An erect, spreading glandular-pubescent annual herb. Stems grooved, puberulous, annual aromatic herb, forming circular patches at the ground. Leaves alternate, sessile, pinnatifid or lobulate, coarsely toothed, pubescent on both surfaces. Heads yellow, heterogamous, globose, sessile, pinnatifid or lobulate, coarsely toothed, pubescent on both surfaces. Calyx with 8-9 rigid teeth, teeth sharply spinescent. Corolla - tube cylindrical, 4-5. Stamens 4, didynamous. Fruits nutlets black, linear to oblong.

Half cup of leaf infusion taken 2 times a day in obstructed menstruation, infusion of leaves also considered as stomachic, deobstruent and antispasmodic (Choudhury et al., 2010).

Gynandropsis gynandra (L.) Benth. (Hulhul)


Leaves used in digestion, lotion of leaf employed as mild stomachic (Kala, 2005).

Gynura nepalensis Benth. (Jali)


Leaves used in digestion, lotion of leaf employed as mild stomachic (Kala, 2005).

Hygrophila difformis Linn. (Sarpat)

An erect or decumbent, pubescent aromatic, annual herb with quadrangular stems swollen at the nodes and rooting below. Leaves petiolate, ovate, crenate-serrate on both sides. Flowers bluish white or purplish, in axillary whorls. Calyx tubular, 5-fid. Corolla 2-lipped. Stamens 4, didynamous. Fruits capsule, narrow, sessile.

Leaves edible, used for poulticing wounds and in tooth ache, antioxidant activity (Debasish et al., 2010).

H. pinnatifida Dalz. (Godadi)


Decoction of whole plant taken in diarrhea (Chopra et al., 2006).

Lantana camara Linn. (Ghaneri)

A straggling or scandent, aromatic shrub with recurved prickles. Leaves ovate or ovate-oblong with cordate or sub-cordate base, scabrid on both side, crenate-serrate. Flowers orange yellow or pink in axillary, spicate heads. Calyx small, membranous 4-5 toothed. Corolla – tube cylindrical, 4-5. Stamens 4, didynamous. Fruits drupe, black.

Used for itch, an antiseptic for wounds, decoction given in tetanus and malaria (Mishra et al., 2008).

L. indica Linn. (Ghaneri)

A hairy scandent shrub, branches-straggling, armed with scattered, prickles. Leaves ovate-oblong, crenate-serrate, acute or sub-obtuse. Flowers white, purple or yellow in axillary head or spike. Calyx 4-5 toothed, small. Corolla 4-5, tube cylindrical. Stamens 4. Fruits drupe purple when ripe.

Leaves used as a cure for snake-bite (Asolkar et al., 2005).

Leonotis nepetaefolia R.Br. (Dhompo)


Inflorescence put in 50gm ghee, boiled to viscous paste and orally administered two spoon full a day for cough. Plants boiled in mustered oil and applied over waist to relieve pain, flowers and seeds used in cuts, wounds and burns (Chopra et al., 2006).

Leonurus sibiricus Linn. (Guma)

An erect, glabrous or pubescent, annual herb. Stems bluntly quadrangular. Leaves palmately pinnatifid, linear,

Dried leaves and flowering tops diuretic, prescribed in hysteria and heart palpitation (Chopra et al., 2006).

**Leucas aspera** Spreng (Gooma)


Juice of leaves applied externally in chronic skin eruptions and painful swelling, anti-inflammatory (Natarajan et al., 1999).

**L. cephalotes** (Wild) Link. (Gooma)


Juice of leaf mixed with honey is taken in cough, the aqueous extract of leaves in constipation. Flowers and leaves chewed in tooth-ache and gum disorder (Ambasta, 2006).

**Lippia nodiflora** Rich. (Bhuiokra)


Infusion of leaves given in colic and as a febrifuge. Root stocks used for piles, jaundice debility and consumption (Chopra et al., 2006).

**Piper sylvaticum** Roxb. (Pahari-pipal)

A slender, creeping undershrub. Leaves ovate or cordate, crenate, base acuminate. Flowers spicate, greenish, spikes dioecious. Stamens 2-4, arranged in axillary and terminal. Fruit berries crowded in cylindrical spikes, red when ripe.

Fruits carminative, used in food preparations (Chopra et al., 2006).

**Pogostemon heyneanus** Benth. (Pachouli/Bhantwas)


Decoction of leaves given in cough and asthma (Mishra et al., 2008).

**Polygonum glabrum** Willd. (Bihagni)


Infusion of leaves given in colic and as a febrifuge. Root stocks used for piles, jaundice debility and consumption (Chopra et al., 2006).

**Salvia plebeia** R.Br. (Bhu-tulasi)

An erect pubescent annual herb with obtusely grooved quadrangular stems. Leaves ovate to lanceolate, crenate, obtuse base, acuminate, glabrous or hairy. Flowers white to bluish-white in spicate racemes. Calyx tubular or crenate, bilipped. Corolla 2-lipped. Stamens 2. Fruits small nutlets, ovoid, brown.

Seeds used in diarrhoea, plant diuretic and anthelmintic (Ambasta, 2006).

**Siegesbeckia orientalis** Linn. (Katampam)

An erect, branched annual herb. Leaves simple, petiolate, opposite, ovate with cuneate base, acute, at the apex irregularly serrate-dentate, pubescent on both surfaces. Heads yellowish, heterogamous in lax panicles. Receptacle convex with elliptic-ovate, glandular-hairy paleaceous

Said to possesses healing properties in gangrenous ulcers and sores. Also diaphoretic and cardiotonic (Chopra et al., 2006).

RESULTS AND DISCUSSION

The aromatic plants collected during investigation are listed in Table 1. It shows that species ordered alphabetically by family, place of collection with collection number, intensity of occurrence, flowering/fruiting and habit/habitat. A total 44 aromatic plant species belonging to 32 genera and 14 families were collected from different forests of Gorakhpur Division. Asteraceae showed 13 aromatic plants followed by Lamiaceae (10) however Araceae, Cannabinaceae, Capparidaceae, Chenopodiaceae and Polygonaceae were represented by only one species. Out of 44 species, 7 species belong to monocot family. During excursions the species viz., *Lantana camara*, *L. indica*, *Ocimum canum*, *Pogostemon* spp., and *Cannabis sativa* were found to be abundantly distributed throughout the forests while the species like *Adenostemma lavenia* (Tehrighat, Kushinagar), *Clausena pentaphylla* (Pakari, Nichlal and Kushmahi), *Hygrophilla pinnatifida*, *Eupatorium cannabinum* (Kushmahi), *Siegesbeckia orientalis*, *Curcuma aromatica* and *Gynura nepalensis* (Nichlal) showed restricted distribution. *Leonurus sibiricus* was recorded from Sahajanawa and Gorakhpur while *Piper sylvaticum* was reported only from Madanpur forest. Remaining species were distributed freely in surveyed areas. *C. aromatica*, *G. nepalensis*, *P. heyneanus* and *P. sylvaticum*, were reported for the first time in these areas.

Table 1: Aromatic plants of forests of Gorakhpur Division.

<table>
<thead>
<tr>
<th>Plants name (Common name)</th>
<th>Family</th>
<th>Occurrence</th>
<th>Place of collection/Collection no.</th>
<th>Flowering &amp; fruiting</th>
<th>Habit &amp; Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><em>Acorus calamus</em> Linn. (Bach)</td>
<td>Araceae</td>
<td>Uncommon</td>
<td>Doma forest, Kushmahi forest/GKU4380</td>
<td>Apr.-Jul.</td>
<td>Rhizomatous herb or under shrub/Herb undergrowth in Sal forest</td>
</tr>
<tr>
<td><em>Adenostemma lavenia</em> (L.)O Kuntze. (Bhenguar)</td>
<td>Asteraceae</td>
<td>Occasionally present</td>
<td>Tehrighat forest, Kushinagar/GKU4348</td>
<td>Feb.-May.</td>
<td>Shrub/Along bank of canal, shady places</td>
</tr>
<tr>
<td><em>Artemisia nilagirica</em> Linn.</td>
<td>Asteraceae</td>
<td>Uncommon</td>
<td>Nichlaul forest, Pakari forest, Kushinagar/GKU4365</td>
<td>Dec.-Apr.</td>
<td>Shrub/Along road side</td>
</tr>
<tr>
<td><em>Blumea eriantha</em> DC. (Kukaraunha)</td>
<td>Asteraceae</td>
<td>Common</td>
<td>Chowk forest, Achalgah forest, Doma forest /GKU4306</td>
<td>Dec.-Apr.</td>
<td>Herb/Dry waste places, along road side</td>
</tr>
<tr>
<td><em>B. laciniata</em> DC. (Kukaraunha)</td>
<td>Asteraceae</td>
<td></td>
<td>Kushmahi forest, Banki forest, Lehradevi forest /GKU4363</td>
<td>Jan.-Apr.</td>
<td>..</td>
</tr>
<tr>
<td><em>B. mollis</em> (D. Don) Merr. (Kukaraunha)</td>
<td>Asteraceae</td>
<td></td>
<td>Nichlaul forest, Madhaulia forest, Campierganj forest /GKU4392</td>
<td>Feb.-May.</td>
<td>..</td>
</tr>
<tr>
<td><em>Caesulia axillaris</em> Roxb. (Bangra)</td>
<td>Asteraceae</td>
<td>Uncommon</td>
<td>Banki forest, Kushmahi forest/GKU4351</td>
<td>Sep.-Jan</td>
<td>Herb/In the field of rice, shady places</td>
</tr>
<tr>
<td><em>Callicarpa macrophylla</em> (L.) Vahl. (Priyangu)</td>
<td>Verbinaceae</td>
<td>Uncommon</td>
<td>Nichlaul forest, Kushmahawa forest, Madanpur forest/GKU4338</td>
<td>Jul.-Jan.</td>
<td>Shrub/Shrubby under in Sal forest</td>
</tr>
<tr>
<td><em>Cannabis sativa</em> Linn. (Bhang)</td>
<td>Cannabinaceae</td>
<td>Abundent</td>
<td>Banki forest, Kushmahi forest, Tilkonia forest /GKU4391</td>
<td>Jan.-Dec.</td>
<td>Herb/Along road side, railway track</td>
</tr>
<tr>
<td><em>Chenopodium ambrosioides</em> Linn. (Ban b thawuwa)</td>
<td>Chenopodiaceae</td>
<td>Uncommon</td>
<td>Kushmahi forest, Kushinagar/GKU4346</td>
<td>Jun.-Sep.</td>
<td>Herb or under shrub/Along bank of canal</td>
</tr>
<tr>
<td><em>Clausena pentaphylla</em> (Roxb.) Dec. (Ratanjot)</td>
<td>Rutaceae</td>
<td>Uncommon</td>
<td>Kushmahi forest, Pakari forest, Nichlal forest /GKU4354</td>
<td>Mar.-Jul.</td>
<td>Shrub/Shrubby underground in Sal forest</td>
</tr>
</tbody>
</table>

Contd..
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colebrookea oppositifolia</td>
<td>Lamiaceae</td>
<td>Uncommon</td>
<td>Tehrighat forest, Nichlaul forest, Madanpur forest/GKU4336</td>
<td>Dec.-Mar.</td>
<td>Shrub/Shrubby undergrowth in Sal forest</td>
</tr>
<tr>
<td>Curcuma aromatica</td>
<td>Zingiberaceae</td>
<td>Occasionally present</td>
<td>Nichlaul forest/GKU4316</td>
<td>Dec.-Mar.</td>
<td>Rhizomatous herb/Herb under growth in Sal forest</td>
</tr>
<tr>
<td>C. zedoaria Rose.</td>
<td>..</td>
<td>Common</td>
<td>Banki forest, Tilkonia forest, Lahredevi forest/GKU4377</td>
<td>Jan.-Jun.</td>
<td>Underground shrub/Waste land</td>
</tr>
<tr>
<td>Cyperus brevifolius (Rottb.) Hassk. (Mutha)</td>
<td>Cyperaceae</td>
<td>..</td>
<td>Kushmahi forest, Banki forest, Gorakhpur/GKU4372</td>
<td>Aug.-Nov.</td>
<td>Herb/Grassland</td>
</tr>
<tr>
<td>C. monocephalus Endl. (Musta)</td>
<td>..</td>
<td>Abundent</td>
<td>Pakari forest, Achalgarh forest, Gorakhpur/GKU4329</td>
<td>Sept.-Nov.</td>
<td>..</td>
</tr>
<tr>
<td>C. triceps (Rottb.) Endl. (Motha)</td>
<td>..</td>
<td>Uncommon</td>
<td>Kushmahi forest, Banki forest/GKU4370</td>
<td>Jul.-Oct.</td>
<td>Herb/In Sal forest</td>
</tr>
<tr>
<td>C. triceps (Rottb.) Endl. (Apavisha)</td>
<td>..</td>
<td>..</td>
<td>Kushmahi forest, Doma forest, Gorakhpur/GKU4327</td>
<td>Sept.-Nov.</td>
<td>Herb/Grassland</td>
</tr>
<tr>
<td>Erigeron bonariensis Linn. (Bonaria)</td>
<td>Asteraceae</td>
<td>Common</td>
<td>Kushmahi forest, Kushinagar, Achalgarh forest/GKU4305</td>
<td>Mar.-Aug.</td>
<td>..</td>
</tr>
<tr>
<td>E. conadensis Linn. (Jarayupriya)</td>
<td>Asteraceae</td>
<td>Common</td>
<td>Banki forest, Kushinagar, Gorakhpur/GKU4303</td>
<td>Jun.-Sept.</td>
<td>Herb/Grassland</td>
</tr>
<tr>
<td>Eugenia heyneana (L.) Wall. (Kathjamun)</td>
<td>Myrtaceae</td>
<td>..</td>
<td>Tehrighat forest, Madhaulia forest, Kushmahi forest/GKU4375</td>
<td>May-Aug.</td>
<td>Shrub/Shrubby undergrowth in Sal forest</td>
</tr>
<tr>
<td>Eupatorium cannabinum Linn. (Tangol-lati)</td>
<td>Asteraceae</td>
<td>Occasionally present</td>
<td>Kushmahi forest/GKU4335</td>
<td>Jan.-Apr.</td>
<td>Herb/Herb undergrowth in Sal forest</td>
</tr>
<tr>
<td>Eupatorium odoratum Linn. (Ayapana)</td>
<td>Asteraceae</td>
<td>Common</td>
<td>Chowk forest, Nichlaul forest, Kushmahi forest/GKU4347</td>
<td>Dec.-Apr.</td>
<td>Shrub/Shrubby undergrowth in Sal forest</td>
</tr>
<tr>
<td>Glycosmis pentaphylla (Retz.) Corr; Hook. (Karjeer)</td>
<td>Rutaceae</td>
<td>..</td>
<td>Nichlaul forest, Kushinagar, Campeirgahn forest/GKU4345</td>
<td>Aug.-Dec.</td>
<td>Shrub/Shrubby undergrowth in Sal forest, along road side</td>
</tr>
<tr>
<td>Grangea maderaspatana (L.) Poir. (Jhinkimundi)</td>
<td>Asteraceae</td>
<td>Uncommon</td>
<td>Kushmahi forest, Kushinagar/GKU4344</td>
<td>Dec.-May.</td>
<td>Herb/Along bank of pond, shady places</td>
</tr>
<tr>
<td>Gynura nepalensis DC. (Jali)</td>
<td>Asteraceae</td>
<td>Occasionally present</td>
<td>Nichlaul forest/GKU4366</td>
<td>Nov.-Feb.</td>
<td>Herb/Shady places, along road side</td>
</tr>
<tr>
<td>Hygrophilla diffinis Linn. (Sarpat)</td>
<td>Acanthaceae</td>
<td>Uncommon</td>
<td>Achalgarh forest, Doma forest, Kushinagar/GKU4309</td>
<td>Aug.-Mar.</td>
<td>Herb/Shady places, along bank of rice field</td>
</tr>
<tr>
<td>H. pinnatifida Dalz. (Godadi)</td>
<td>..</td>
<td>Occasionally present</td>
<td>Kushmahi forest/GKU4343</td>
<td>Jab.-Mar.</td>
<td>Herb/Along bank of canal</td>
</tr>
<tr>
<td>Lantana camara Linn. (Ghaneri)</td>
<td>Verbenaceae</td>
<td>Abundent</td>
<td>Banki forest, Nichlaul forest, Gorakhpur/GKU4376</td>
<td>Jan.-Dec.</td>
<td>Shrub/Along road side, railway tract.</td>
</tr>
<tr>
<td>L. indica Roxb. (Ghaneri)</td>
<td>..</td>
<td>..</td>
<td>Madhaulia forest, Doma forest, Gorakhpur/GKU4355</td>
<td>Oct.-Dec.</td>
<td>..</td>
</tr>
<tr>
<td>Leonotis nepetaeefolia R. Br. (Dhompo)</td>
<td>Lamiaceae</td>
<td>Common</td>
<td>Kushmahi forest, Achalgarh forest, Nichalul forest/GKU4314</td>
<td>Dec.-Mar.</td>
<td>..</td>
</tr>
</tbody>
</table>

Contd..
Flowering and fruiting periods are the most important stage in the life cycle of plant species. Seasonal flowering and fruiting related life cycle of aromatic plants. It will assure their proper distribution and maintain their diversity in that region. The study revealed that most of the aromatic species were found to be flowering and fruiting during winter to summer transition (Table 1). The seasonal variations in flowering and fruiting observed in this study did not follow the earlier records (Ali and Dixit, 1986; Bhatt and Bhatt, 2007). This may be due to change in climatic condition because various phenological characters of plant species are regulated by environmental factors.

The plant materials either fresh or dried are being used in many ways. Fresh materials are usually taken orally or applied externally after being pounded. Recently workers reported the curative properties of ethno medicinal plants in skin disease ailment (Khumbmayung et al., 2005; Tripathi and Srivastava, 2010). The present study revealed that frequent use of aromatic plants is to treat gastrointestinal disorders including stomach ache, ulcers, diarrhoea, rheumatism and tooth ache. Some species like *Blumea eriantha*, *E. cannabinum* and *L. sibiricus* are diuretic used in hysteria, as purgative and heart palpitation. Further the

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leonurus sibiricus</strong> Linn. (Guma)</td>
<td>..</td>
<td>Uncommon</td>
<td>Gorakhpur, Sahajanawa/GKU4357</td>
<td>..</td>
<td>Herb/Dry sandy places, along road sandy.</td>
</tr>
<tr>
<td><strong>Leucas asperea</strong> Spreng. (Goma)</td>
<td>..</td>
<td>Abundent</td>
<td>Tehrighat forest, Doma forest/GKU4312</td>
<td>May-Jul.</td>
<td>Herb/Cultivated field</td>
</tr>
<tr>
<td><strong>Leucas cephalotes</strong> Spreng. (Goma)</td>
<td>Lamiaceae</td>
<td>Common</td>
<td>Chowk forest, Banki forest, Kushmahawa forest /GKU4320</td>
<td>Jul-Sep.</td>
<td>Herb/Moist sandy places</td>
</tr>
<tr>
<td><strong>Lippia nodiflora</strong> Rich. (Buiiokra)</td>
<td>Verbenaceae</td>
<td>..</td>
<td>Kushmah forest, Pakari forest, Gorakhpur/GKU4331</td>
<td>Jan-Jul.</td>
<td>Shrub/Shady places, along road side</td>
</tr>
<tr>
<td><strong>Nepeta hindostana</strong> Linn. (Bilaiyalotan)</td>
<td>Lamiaceae</td>
<td>Common</td>
<td>Madanpur, Kushmah forest, Gorakhpur/GKU4322</td>
<td>Jan-Feb.</td>
<td>Herb/Damp places</td>
</tr>
<tr>
<td><strong>Ocimum canum</strong> Sims. (Bantulsi)</td>
<td>..</td>
<td>Abundent</td>
<td>Kushmah forest, Gorakhpur, Chowk forest /GKU4368</td>
<td>Dec-Mar.</td>
<td>Herb/Waste places</td>
</tr>
<tr>
<td><strong>Piper sylvaticum</strong> Roxb. (Pahari-pipal)</td>
<td>Piperaceae</td>
<td>Occasionally</td>
<td>Madanpur/GKU4353</td>
<td>Jul-Aug., Dec-Jan.</td>
<td>Climber/In babul forest, along railway tract</td>
</tr>
<tr>
<td><strong>Pogostemon heyneanus</strong> Benth. (Pachouli)</td>
<td>Lamiaceae</td>
<td>Abundent</td>
<td>Kushmah forest, Chowk forest, Nichlaul forest /GKU4341</td>
<td>Jan-Apr.</td>
<td>Shrub/Shady places, along road side</td>
</tr>
<tr>
<td><strong>P. plectranthoides</strong> Desf. (Pachouli)</td>
<td>..</td>
<td>..</td>
<td>Doma forest, Pakari forest, Madhaulia forest/GKU4326</td>
<td>..</td>
<td>..</td>
</tr>
<tr>
<td><strong>Polygonum glabrum</strong> Willd. (Bihagni)</td>
<td>Polygonaceae</td>
<td>Common</td>
<td>Kushmah forest, Tilkonia forest, Gorakhpur/GKU4379</td>
<td>Sept-Apr.</td>
<td>Herb/Shady moist places</td>
</tr>
<tr>
<td><strong>Salvia plebeia</strong> R. Br. (Bhu-tulasi)</td>
<td>Lamiaceae</td>
<td>Uncomon</td>
<td>Achalgarh forest, Tehrighat forest, Kushinagar/GKU 4307</td>
<td>Jan-May.</td>
<td>Herb/Along road side, Cultivated field</td>
</tr>
<tr>
<td><strong>Siegesbeckia orientalis</strong> Linn. (Katampam)</td>
<td>Asteraceae</td>
<td>Occasionally present</td>
<td>Nichlaul forest/GKU4378</td>
<td>Oct-Jan.</td>
<td>Herb/Along road side</td>
</tr>
</tbody>
</table>
plants are used in treatment of respiratory tracts disorder (Cough, Bronchitis and cold) which are generally administered by gargling or by drinking a decoction. An interesting remedy is the use of *Leonotis nepetaefolia* inflorescence in treatment of cough. The Inflorescence put in 50gm ghee, boiled to viscous paste and orally administered two spoon full a day for cough. Plants boiled in mustered oil and applied over waist to relieve pain.

Science engaged in multipurpose utilization of aromatic plants which may lead to decrease in species abundance and finally, even to local extinction. Plant species such as *A. lavenia, C. aromatic, E. cannabinum, G. nepalensis, H. pinnatifida, P. sylvaticum and S. orientalis* were found to be occasionally distributed in the forests of Gorakhpur Division. The medicinal and aromatic plants have future potential to develop herbal medicines for various disease ailments. So people should have knowledge the importance of plant species in the community. By applying this, a sustainable system should be developed for conservation of aromatic plants. Hopefully this study will positively contribute to further research and conservation of aromatic plant resources as well as to represent important assets to the health care.

**ACKNOWLEDGEMENT**

Financial assistance provided by CST UP Lucknow is duly recognized. Authors are thankful to Head, Department of Botany, DDU Gorakhpur University for providing necessary lab facility and to the staff of BSI, Dehradun to validate the authentication of plant specimens.

**REFERENCES**


